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## SCIENTIFIC BOOKS

*The Eurypterida of New York.* By Drs.

JOHN M. CLARKE and RUDOLF RUEDEMANN.

New York State Museum Memoir No. 14.

Albany. 1912. 2 vols.

This handsome memoir, illustrated by 121 text-figures and accompanied by an atlas of beautifully engraved plates, marks a notable addition to the series of special monographs published by the New York State Educational Department, the importance of which from a purely scientific standpoint can not be overestimated. Granted that a knowledge of the wonderful world we live in and of the manifold variety of life inhabiting it is of value for its own sake, even though it yields no direct material returns, there can be no question that the publication of this series of memoirs has contributed largely toward the advancement and diffusion of knowledge, in which respect the empire state long ago took the lead and has set a worthy example for sister commonwealths to emulate.

The new monograph before us is of a character such as might be expected of two authors who are recognized as holding front rank among invertebrate paleontologists. Not merely is this one of the regular contributions of trained specialists, valuable though it is as a great storehouse of facts. It is something more besides. Those familiar with the group of organisms considered must acknowledge it to be a philosophic essay which bears the stamp of authority, since everywhere one finds that conclusions have been reached only after mature deliberation, upon rigorous analysis of the evidence (often complex and confusing), and in the light of all previous researches that have been conducted in this difficult field.

As is befitting a scholarly production, the memoir is embellished by a graceful literary style, in which lucidity and directness of expression are conspicuous elements. Hugh Miller at his best could not have employed a more appropriate and smoothly flowing phrase, though he may have unwittingly inspired it, for we find his name bestowed upon one of these peculiar-looking creatures which

in the parlance of Scotch quarrymen are called "seraphim."

This volume represents the fruition of long-cherished plans, and more than fifteen years of patient collecting, preparation and study of an immense quantity of material. In localities formerly productive of good specimens but now no longer worked, nothing was thought of tearing down and rebuilding many rods of stone wall and foundations of old barns, on the chance of securing a bit of fresh evidence, or of following up a single new clue. In point of diversity, the thousands of specimens which passed under scrutiny during the preparation of this memoir exceed all other collections in the world. Little wonder, therefore, that so exhaustive an investigation should have yielded important new results and thrown a flood of light upon the structure and relations of this extinct order of merostomes. In fact, the organization of eurypterids has probably been studied in greater detail than that of any other group of fossil animals, and our precise knowledge of them is comparable with that which we have of recent arachnids. The theme is a fascinating one, and touches closely on human interests when we consider the theory, recently revived in some quarters, of the arachnid origin of vertebrates.

The general thesis of the book is that eurypterids, the king crab and other merostomes are arachnids, and share a common origin with the scorpion and its allies. As for the scorpions, to which a special section is devoted in the appendix, it is worthy of note that they exceed all other animal forms of high elaboration in point of racial longevity, having had a continuous existence from the Silurian onward.

A very important chapter is that which is devoted to a comparison of the anatomical structure and larval stages of development as observed in eurypterids, *Limulus* and scorpions. The conclusions reached from this line of research are: (1) that "the limulids and eurypterids were probably separate in pre-Cambrian time"; (2) that "neither *Limulus* nor the scorpions are derivable from the

eurypterids, but that all three, while related, have early separated, and that eurypterids are still nearest in their general aspect to this common ancestor"; and (3), while we have no clue as to what this common ancestor was, it is clear that the earliest and most primitive known crustacea (trilobites) do not stand in that relation, and therefore the derivation of various types of these arachnids from arthropods more primitive than the crustaceans seems a necessary inference. It is recalled in this connection that Bernard derives the crustacea from a bent carnivorous annelid, and that Beecher regards this view as partly confirmed by his discoveries concerning the ventral anatomy of trilobites.

For the study of the ontogeny of eurypterids the authors had at their command an unrivaled series of larval stages of four genera, ranging in size from a length of 2 mm. or less up to the adult condition. A comparison of growth stages leads to the important conclusion that there is a "general parallelism in the ontogeny of the eurypterids and *Limulus*." Not less brilliant and far-reaching is the discovery that the Cambrian genus *Strabops* fulfills tolerably well our conception of a generalized prototype from which Silurian eurypterids have descended. The adult *Strabops* so closely resembles the young of later genera as to justify the statement that eurypterids actually pass through a "*Strabops* stage" during their nepionic development. Herein is found fresh evidence in favor of the so-called recapitulation theory, or biogenetic law, as important in its way as the recognition of the "*Prestwichia* stage" of *Limulus*, and the goniatic and ceratitic stages of ammonites.

Confirmatory evidence in favor of the homologies between eurypterids and king crabs is found in the fact that *Pterygotus* and *Limulus* show a remarkable identity in structure of the compound eyes. The view of their common relationships thus receives strong support from a new body of facts, for, as shown by Watase and others, the visual organs of *Limulus* form an extremely peculiar structural type. Among the various special anat-

omies that have been minutely investigated, those which have to do with the compound eyes and genital appendages are particularly commendable, and the results gained are of signal importance.

The special essay on morphology and anatomy, together with the discussion as to the mode of life of these creatures, are replete with new and interesting details. Owing to limitations of space, we can only refer to these in the most casual way, and it must suffice to note merely the captions of some of the subordinate themes discussed, as, for instance, the following: Geological distribution and bionomic relations; mode of life; taxonomic relations; synoptic table of North American eurypterids. These lead up to the principal chapter, consisting of 232 pages, which is devoted to a systematic account of the group and is in every way most excellent. After this follows an appendix of 40 pages, in which are set forth the results of investigations and discoveries made since the body of the work went to press. Besides the valuable note on Silurian scorpions, already referred to, there are considered here the relations of several problematical forms, *inter alia* the pre-Cambrian bodies called *Beltina*, the genus *Hastimima* of White, and the suborder *Limulava* of Walcott. Appendices as important as this are welcome in any work for the choice nuggets of new truth they contain.

The greater part of this memoir necessarily deals with the concrete facts of observation and their adjustment to the present state of our knowledge. Nevertheless, an undercurrent of ideas appears to run through various passages, sometimes only suggested or hinted at, or again included within broad generalizations. And the central thought that informs these ideas proves to be an insistence upon the *fundamental human interest of the theme*. For really, is not the general theme one which involves questions concerning our own remote ancestry? And who knows whether we may not discover landmarks which shall point for us the way taken by advancing creation in its slow march through the ages, the end whereof is man? A gradual progression leading up to

man, that mite, that mere atom, that ephemeral fragment of nature! How insignificant a goal; and yet, strange paradox, that mite and that atom is able to comprehend nature, and great enough to know his own littleness. Alone among earth's creatures this being has intelligence fine enough to perceive that his thought is everything, even though it be "but a flash in the midst of a long night"; and even though all life be "only a short episode between two eternities."

Reflections of this sort must certainly have inspired the minds of the authors when writing many pages of this memoir; and in the reviewer's judgment the work has suffered nothing in consequence. Not long ago one Anatole France wrote a natural history of penguins. It is a capital work, and has opened our eyes to new and alluring possibilities of ornithology. But in the preface the author lays down certain rules for the guidance of fellow naturalists if they would greatly extend human knowledge and leave imperishable monuments behind them. Now assuredly Drs. Clarke and Ruedemann have done these things, as this memorial witnesses, yet they have gone exactly contrary to rule. Whence we infer that the learned academician must have been mistaken, for surely no one will accuse him of ever being ironical.

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*Palæolithic Man and Terramara Settlements in Europe.* By ROBERT MUNRO. New York, Macmillan Co. 1912. Pp. 507. Price \$5.50 net.

"This volume contains the Munro Lectures in Anthropology and Prehistoric Archeology for 1912, being the first course since the lectureship was founded," in the University of Edinburgh. It seems especially fitting that the eminent archeologist after whom these courses are named should himself be the first to fill that lectureship. A standard is given which is of the highest and which, we may hope, subsequent lecturers will strive to maintain.

Those who are not in the small circle of prehistoric archeologists are prone to look upon their work askance, if indeed they do not ignore it altogether. "Early Bronze is a good enough term for articles in a museum," they say, "but it does not suggest a spiritual being. We can not get on terms of spiritual intimacy with the Early Bronze people. For all their flint arrow-heads, or bronze instruments, we can not think of them as fellow men." These prevalent views can come only from a distorted perspective, a perspective in which only the dull unrelated side of these things is open to our vision—when we see them as objects rather than as evidences. It must be confessed that the specialist is often more than indirectly responsible for this prevalent attitude. To Dr. Munro we must feel grateful for a masterful treatise which, without neglecting the minutiae and details, subordinates them to their true place in a scheme of wider relations. His facts are evidences, his evidences appear in their proper place in the larger *Culturgeschichte*. We can not be too grateful that, to use his own phrases, "the gnawing tooth of time" has allowed us to rescue from the "dustbins of ages" these few pages of an early history which archeological finds furnish.

The volume is divided into two parts, the first treating of Anthropology: Paleolithic Man in Europe, with supplementary chapter on the Transition Period, the second with Prehistoric Archeology: Terremare, and their Relation to Lacustrine Pile-structure. The volume covers a ground which no other English one duplicates, that of Sollas being more closely related to the first part, and that of T. E. Peet to the second.

Of the first part we have only two criticisms: A map showing the locations of the various described sites would add greatly to the value of the exposition, and a chapter dealing with the methods of burial would have been a valuable addition. The excellent maps incorporated in the author's *Lake Dwellings of Europe*, have their counterpart in the second portion of the present work, which deals with the Po Valley, and there is a chap-